

Global Environment for Networking Innovations (GENI): Establishing the GENI Project Office (GPO) (GENI/GPO)

Program Solicitation
NSF 06-601



National Science Foundation

Directorate for Computer & Information Science & Engineering
Division of Computer and Network Systems
Division of Computing and Communication Foundations
Division of Information & Intelligent Systems

Letter of Intent Due Date(s) (required):

October 25, 2006

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

December 15, 2006

REVISION NOTES

In furtherance of the President's Management Agenda, in Fiscal Year 2006, NSF has identified programs that will offer proposers the option to utilize Grants.gov to prepare and submit proposals, or will require that proposers utilize Grants.gov to prepare and submit proposals. Grants.gov provides a single Government-wide portal for finding and applying for Federal grants online.

In response to this program solicitation, proposers may opt to submit proposals via [Grants.gov](#) or via the [NSF FastLane](#) system.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Global Environment for Networking Innovations (GENI: Establishing the GENI Project Office (GPO) (GENI/GPO)

Synopsis of Program:

The Global Environment for Networking Innovations (GENI) is an experimental facility concept conceived by the computing research community. GENI promises to support the experimental exploration of robust new

networking and distributed systems architectures and services that will revolutionize computing and simultaneously contribute to US competitiveness in IT and economic growth.

In order to support the GENI design and development process, the Directorate for Computer and Information Science and Engineering (CISE) will support the work of a GENI Project Office (GPO). Working closely with the computing research community, the GPO will assume responsibility for completion of all GENI preconstruction planning requirements as described in [NSF's Guidelines for Planning and Managing the Major Research Equipment and Facilities Construction Account](#). Upon successful completion of the multiple stages comprising GENI design, and contingent upon support from NSF management, the National Science Board, the Administration and the Congress, GENI will proceed to the construction phase with funding provided from the agency's Major Research Equipment and Facilities Construction (MREFC) account.

It is anticipated that the GPO will then have full responsibility for overseeing the construction of the facility, ensuring that GENI is delivered on time and within budget. Upon successful GENI construction and commissioning, the GPO may subsequently operate the facility in service to the computing research community.

To ensure that all GENI activities are driven by fundamental research opportunities in networking and distributed systems, the GPO will work closely with the computing research community in all aspects of the design, development, construction and operation of GENI. The community's research interests in GENI will be represented by a GENI Science Council (GSC) comprised of research leaders in networking and distributed systems; the GSC will be chartered and supported by the NSF-funded Computing Community Consortium. The GPO will work in partnership with the GSC in all aspects of GENI design, development, construction and operation. The GSC will also develop a GENI Science Plan, a "living document" that will evolve over time as new scientific opportunities and challenges are identified.

Cognizant Program Officer(s):

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Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1

Anticipated Funding Amount: \$12,500,000 per year for up to 4 years (subject to availability of funds). Administrative project management operations costs for the GENI Project Office are not expected to exceed \$2.5 million per year. During the award period, additional funds of up to \$10 million per year will be made available for necessary development and prototyping activities that are expected to be competitively bid. In exceptional circumstances where the GPO has unique technical expertise, the GPO may conduct GENI development and prototyping if it is determined by the GSC to be in the best interests of the computing research community and the GENI project. NSF will retain approval authority for all development and prototyping support provided. The governance approach used to oversee the process for identifying, prioritizing and supporting development and prototyping activities must be described in proposals submitted in response to this solicitation. Proposals submitted in response to this solicitation should NOT identify specific development and prototyping activities or subawardees.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- Academic Institutions located in the U.S.: U.S. universities and colleges located in the U.S.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

PI Limit:

None Specified

Limit on Number of Proposals per Organization: 1

An organization may participate in no more than one GENI/GPO proposal submitted to this competition. The submission of collaborative proposals as defined in NSF's Grant Proposal Guide is not permitted.

Limit on Number of Proposals per PI: 1

An individual may appear as PI, co-PI, Senior Personnel or Consultant on **no more than one** GENI/GPO proposal submitted to this competition.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **Full Proposals:**
 - Full Proposals submitted via FastLane: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
 - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: <http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf>)

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required by NSF.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

- **Letter of Intent Due Date(s) (required):**

October 25, 2006

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions: Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements: Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

The Global Environment for Networking Innovations (GENI) promises a major paradigm shift in the way research in networking and distributed systems is conducted. Through the work of a community-based group – the GENI Planning Group - the community has conceptualized the motivation for GENI as described below and at <http://www.geni.net/GDD/GDD-06-07.pdf>.

Today's Internet, based on design decisions made in the 1970's, is extraordinarily successful. It is remarkable that only now, after 30 years, assumptions built into its design begin to limit its potential. These design assumptions cannot be removed by minor incremental adjustments of the existing network, and if left unchecked, they will limit society's ability to utilize and

exploit this new technology.

- The Internet is not secure. We hear daily about worms, viruses, and denial of service attacks, and we have reason to worry about massive collapse, due either to natural errors or malicious attacks. Problems with “phishing” have prevented institutions such as banks from using email to communicate with their customers. Trust in the Internet is eroding. The current Internet cannot deliver to society the potential of emerging technologies such as wireless communications. Even as all of our computers become connected to the Internet, we see the next wave of computing devices (sensors and controllers) rejecting the Internet in favor of isolated “sensor networks”.
- The Internet does not provide adequate levels of availability. The design should be able to deliver a more available service than the telephone system. In particular, it should meet the needs of society in times of crisis by giving priority to critical communications.
- The design of the current Internet actually creates barriers to economic investment and enhancement by the private sector. For example, barriers to cooperation among Internet Service Providers have limited the creation and delivery of new services. A large number of specific problems with the Internet today have their roots in an economic disincentive, rather than a technical lack.
- The Internet was not designed to make it easy to set up, to identify failures and problems, or to manage. This limitation applies both to large network operators and the consumer at home. Difficulties with installation and debugging of the Internet in the home have turned many users away, limiting the future penetration of the Internet into society.

These limitations are deeply rooted in the design of the Internet. It is easy to overlook them because of the astonishing success of the Internet to this point. In the mere decade since the Internet left the research arena and entered the commercial world, it has substantially changed the way we work, play, and learn. There are few aspects of our life that aren't touched in some way by the Internet, and few (if any) technological developments have had such broad impact in such short time. However, we may be at an inflection point in the social utility of the Internet, with eroding trust, reduced innovation, and slowing rates of uptake.

A second, equally important motivation complements the imperative for action to correct these limitations. This second motivation is that the Future Internet foster, rather than inhibit, emerging applications and technologies. Imagining that the Internet simply does better what it already does today is a very narrow view of the future. Yet, for a variety of reasons, the Internet today is poorly positioned to accommodate this blossoming of new capabilities. To realize its potential, a Future Internet must enable and encourage:

- A world where mobility and universal connectivity is the norm, in which any piece of information is available anytime, anywhere.
- A world where more and more of the world's information is available online—a world that meets commercial concerns, provides utility to users, and makes new activities possible. A world where we can all search, store, retrieve, explore, enlighten and entertain ourselves.
- A world that is made smarter—safer, more efficient, healthier, more satisfactory—by the effective use of sensors and controllers.
- A world where we have a balanced realization of important social concerns such as privacy, accountability, freedom of action and a predictable shared civil space.
- A world where “computing” and “networking” is no longer something we “do”, but a natural part of our everyday world. We no longer use the Internet to go to cyber-space. It has come to us. A world where these tools are so integrated into our world that they become invisible.

A key element of any effort to redesign the Internet is a strategy for fostering the research cycle—drastically lowering the barriers that promising new directions developed by the research community face before transition to industrial development and deployment within the commercial Internet. This requires that we move well beyond the methodologies and facilities used today. An experimental facility that enables the research community to address [important scientific] questions is a key part of a seamless, end-to-end research process for taking ideas from conception, through validation, to deployment.

Unlike traditional network testbeds, GENI is conceived as a general-purpose facility that places essentially no limits on the network architectures, services, and applications that can be evaluated. Unlike traditional network testbeds that either limit researchers to incremental changes or limit researchers to synthetic workloads, GENI is designed to allow both clean-slate designs and experimentation with real users under real-world conditions. Unlike traditional testbeds that provide no credible deployment path to the commercial world, GENI represents a model in which incremental adoption of new services has the potential to drive wide-spread deployment.

Excerpts from the GENI Project Execution Plan <http://www.geni.net/GDD/GDD-06-07.pdf>

With support from the Directorate for Computer and Information Science and Engineering (CISE), the GENI Planning Group and its seven technical working groups have prepared an initial strawman design and supporting Project Execution Plan (PEP). This design is being shared broadly for comment and is available for review at <http://www.geni.net/>. CISE has also

supported a number of town hall meetings to gather community input that is further informing and refining the facility design.

II. PROGRAM DESCRIPTION

In order to formalize the GENI design and development process and to ensure the appropriate engagement of organizations and individuals with experience in the planning and management of research infrastructure construction projects, CISE is calling for proposals from organizations committed to serve as the GENI Project Office (GPO). Working closely with the computing research community, the GPO will assume responsibility for the project management necessary to successfully complete all planning, design and development activities, and essential to adequately prepare for GENI construction.

Upon successful completion of GENI design and development activities, and contingent upon support from NSF management, the National Science Board, the Administration and the Congress, GENI will proceed to the construction stage with funding provided from NSF's Major Research Equipment and Facilities Construction (MREFC) account. It is anticipated that the GPO will then have full responsibility for overseeing the construction of the facility, including managing subcontracts, defining milestones, and ensuring that GENI is delivered on time and within budget. Upon successful GENI construction and commissioning, the GPO may subsequently operate the facility in service to the computing research community. Separate awards will be made for GENI construction and operations.

To ensure that all GENI activities are driven by fundamental research opportunities in networking and distributed systems, the GPO will work closely with the computing research community in all aspects of the design, development, construction and operation of GENI. The community's research interests in GENI will be represented by a GENI Science Council (GSC) comprised of research leaders in networking and distributed systems. The GSC will be chartered and supported by the newly established Computing Community Consortium. The GSC will develop a GENI Science Plan that describes the research opportunities to be addressed via GENI. The GENI Science Plan will serve as a "living document" evolving over time as new scientific opportunities and challenges are identified.

Preparing for GENI Construction: Supporting GENI Design and Development.

The design and development stages NSF large facility projects like GENI are described in [*NSF's Guidelines for Planning and Managing the Major Research Equipment and Facilities Construction Account*](#). As defined in these Guidelines, projects progress through three distinct design stages, culminating in the Final Design Review (FDR), when the GPO is expected to:

- Submit a construction-ready Project Execution Plan (PEP)
- Submit a construction-ready GENI system design, specifications and scopes of work for competitive bidding
- Finalize a detailed construction plan with bottom-up cost estimates and contingency calculations linked to risk assessment
- Submit a Project Management Control System for technical and financial status reporting
- Demonstrate successful development and prototyping of technologies essential to project construction
- Finalize change control processes
- Finalize a risk analysis and mitigation plan, including a security plan that protects GENI from malicious attack or malevolent use
- Finalize processes essential to robust software design, development and management throughout the GENI lifecycle
- Finalize GENI annual operations and maintenance costs
- Finalize the GENI intellectual property model
- Create the core management organization responsible for the overall construction of GENI and finalize the staffing plan for the additional staff need to support the construction effort.
- Finalize commitments with academic, industry, interagency and international partners
- Establish a final project baseline

To progress to the FDR, the GPO must successfully pass the Conceptual Design Review (CDR) and Preliminary Design Review (PDR) as described in NSF's Guidelines for Planning and Managing the MREFC Account as determined by merit review. In the Conceptual Design, Preliminary Design and Final Design Reviews, a panel of independent experts will examine: the degree to which the GENI design is responsive to the evolving GENI Science Plan; and the GPO's project management plans for remaining GENI design, construction and operations activities.

GENI Construction and Commissioning

Upon approval of the final design baseline by the National Science Board and with the support of the Administration and the Congress, GENI construction activities will begin.

Contingent upon the successful performance of the GPO during the design stages, it is expected that the GPO will assume all responsibility for GENI construction and operations. *Separate awards will be made for GENI construction and operations.* NSF will provide guidance to the GPO on project construction, commissioning and operations as the project progresses through the MREFC lifecycle.

GPO Management

The successful operation of the GPO will require a dedicated project staff whose expertise includes: a demonstrated ability to work collaboratively with and provide service to the computing research community; effective management of advanced networking infrastructure projects, including planning, construction and operations; effective management of large-scale software-intensive projects, including design, development, implementation and lifecycle management; development of organizations; technical report editing and web-based publications; and interactive web site development, usage, and maintenance.

The lead Principal Investigator (PI) will serve as the “Project Director” for the GPO, will work full-time on the project, and thus will have direct day-to-day involvement in the effort. The Project Director must have an established track record of leadership and managing teams and projects of this scale and scope and will play a critical role in the success of the project and will take overall responsibility for the project. The GPO Project Director will work closely with the cognizant NSF Program Officials and the GSC in order to keep all parties informed of GPO activities and to solicit input on aspects related to project planning and implementation. The GPO Project Director will also serve as an *ex officio* member of the GSC. The Project GPO Director will be assisted by others who bring additional scientific and administrative expertise necessary to the successful execution of GPO responsibilities. Office and meeting facilities must be available, including Internet communications capabilities and institutional meeting space necessary to conduct planned activities.

III. AWARD INFORMATION

Anticipated Type of Award: Cooperative Agreement

Estimated number of Awards: 1

Anticipated Funding Amount: \$12,500,000 per year for up to 4 years (subject to availability of funds). Administrative project management operations costs for the GENI Project Office are not expected to exceed \$2.5 million per year. During the award period, additional funds of up to \$10 million per year will be made available for necessary development and prototyping activities that are expected to be competitively bid. In exceptional circumstances where the GPO has unique technical expertise, the GPO may conduct GENI development and prototyping if it is determined by the GSC to be in the best interests of the computing research community and the GENI project. NSF will retain approval authority for all development and prototyping support provided. The governance approach used to oversee the process for identifying, prioritizing and supporting development and prototyping activities must be described in proposals submitted in response to this solicitation. Proposals submitted in response to this solicitation should NOT identify specific development and prototyping activities or subawardees.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- Academic Institutions located in the U.S.: U.S. universities and colleges located in the U.S.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

PI Limit:

None Specified

Limit on Number of Proposals per Organization: 1

An organization may participate in no more than one GENI/GPO proposal submitted to this competition. The submission of collaborative proposals as defined in NSF's Grant Proposal Guide is not permitted.

Limit on Number of Proposals per PI: 1

An individual may appear as PI, co-PI, Senior Personnel or Consultant on **no more than one** GENI/GPO proposal submitted to this competition.

Additional Eligibility Info:

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent (*required*):

Letters of intent are required and should be submitted by via FastLane by October 25, 2006. The letter of intent should include: names and organizational affiliations of the Principal Investigator and co-Principal Investigator(s); the telephone number and e-mail addresses of the Principal Investigator and an authorized organizational representative of the submitting institution/organization, a list of participating individuals and organizations, and a brief summary of the proposed project (not more than 500 words). Letters of intent will not be evaluated or used to determine funding decisions. They are requested to assist NSF in planning the review process. The submission of a letter of intent enables NSF to begin identifying potential panelists before the proposal submission deadline. Letters of intent are treated with the same confidentiality as NSF proposal submissions. NSF will acknowledge receipt of the letter of intent via e-mail to the Principal Investigator.

Letter of Intent Management Conditions:

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- SPO Submission is Not Required when submitting Letters of Intent
- Submission of multiple Letters of Intent are Not allowed

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (<http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf>). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

The Project Description section must not exceed **50 pages** including figures, charts, graphs, maps, photographs, and other pictorial representations. Non-conforming proposals will be returned without review.

The Project Description **MUST** contain the following sections with the headings shown below.

Section I. Contributions of Key Personnel in Past 5 Years (up to 5 pages).

For the Principal Investigator/Project Director and other Key Personnel, describe contributions made in the most recent 5 years that demonstrate:

- Ability to work effectively with the computing research community;
- Experience with advanced networking infrastructure planning, construction, deployment and operations;
- Effective development of organizations;
- Effective management of large infrastructure projects, including establishing project management control systems and usage of earned value management methodology;
- Effective management of large-scale software-intensive projects.

Reviewers will be asked to comment on the quality of the prior work described in this section of the proposal.

Section II. GPO Project Development Plan.

The Project Development Plan (PDP) is the document that describes activities, budget and schedules for all preconstruction planning. Proposers are strongly encouraged to consider [*NSF's Guidelines for Planning and Managing the Major Research Equipment and Facilities Construction Account*](#) in developing the PDP.

II.1 Scope of Work

Define in fine detail the scope of work necessary to assume responsibility for the current draft of the Project Execution Plan and related GENI design from the GENI Planning Group, and continue these planning efforts through completion of the Final Design Review. Identify and discuss all project goals and associated milestones.

Provide a comprehensive, concise description of project management activities that are keyed to the goals and milestones. Provide rationale for why these activities are identified, who will lead, facilitate, and participate in them (cite types of backgrounds, disciplines, sectors, etc., rather than specific participant names), and the methods/metrics that will be used to evaluate the GPO's effectiveness in realizing them. Proposers should not identify specific development and prototyping activities. Proposers should instead describe the processes they will use to identify, prioritize and support necessary development and prototyping activities.

II.2. Risk Mitigation Plan.

Discuss any risks associated with completing the GENI design process, including technical and organizational risks. Discuss lessons learned by the proposing team from past experience.

II.3. Project Schedule.

Provide a Gantt chart identifying key milestones and major activities over the project period. Identify and discuss the critical path for development to the construction phase of the project. The schedule should show the sequencing of all major activities to be conducted in sufficient detail to justify the proposed budget. It is currently envisioned that the GPO will be prepared to host the CDR within two months of the award, and the PDR within a further four month period.

II.4. Management Plan, Organizational Structure, and Project Staffing.

Describe the GPO's organizational and management structure, and the qualifications of GPO staff. Describe the structure and processes to be used to provide effective governance for GENI, including ensuring productive, collaborative interactions with the GSC and the anticipated GENI research community. Describe the approach to be used to identify and prioritize development and prototyping activities, and the competitive process to be used in the selection of development and prototyping subawardees and consultants. Proposers should NOT identify specific development and prototyping subawardees in proposals submitted in response to this solicitation.

Provide a table that provides the following information for each individual participating in the project: name, position/title on the project, level of effort (monthly and annually), activities assigned, and responsibilities for achievement of key project goals and milestones.

Provide a functional project budget in tabular form showing how resources will be allocated.

Provide a plan for annual project critical self-assessment that includes measurable metrics and discuss how the results of the self-assessment will be used for project improvement.

II.5. GPO Facilities.

Describe office and meeting facilities that will be available for the project, including office equipment, communications capabilities, and institutional meeting space necessary to conduct project business.

B. Budgetary Information

Cost Sharing: Cost sharing is not required by NSF in proposals submitted to the National Science Foundation.

C. Due Dates

- **Letter of Intent Due Date(s) (required):**

October 25, 2006

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

December 15, 2006

D. FastLane/Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are available at: <https://www.fastlane.nsf.gov/a1/newstan.htm>. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: <https://www.fastlane.nsf.gov/fastlane.jsp>.

- **For Proposals Submitted Via Grants.gov:**

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: <http://www.grants.gov/CustomerSupport>. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this

solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program and, if they meet NSF proposal preparation requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts with the proposer.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

What is the intellectual merit of the proposed activity?

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

NSF staff will give careful consideration to the following in making funding decisions:

Integration of Research and Education

One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities

Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

Additional Review Criteria:

In consideration of a proposal's Intellectual Merit and Broader Impacts, the following review criteria will guide the reviewer's evaluation:

Comment upon the capabilities of the proposing team. Does the proposing team demonstrate strong experience, managerial, technical and administrative, in projects similar in scope to that proposed here? Do prior contributions provide convincing evidence that the proposers understand and are prepared to handle the major challenges of this project? Does the proposing team have experience working with the research community and with large, software-intensive projects?

Do the goals, milestones and activities proposed in the Project Development Plan cover all the essential aspects of GENI design and development as described in [NSF's Guidelines for Planning and Managing the Major Research Equipment and Facilities Construction Account](#).

Did the submitting organization provide a reasonable plan for risk mitigation? If not, describe the missing components.

Does the project schedule appear reasonable? Were the key milestones identified?

Did the submitting organization provide an adequate management plan? Is the governance, managerial and organizational approach described appropriate for an effective GPO? Are the proposed staff qualified? Does the proposed competitive bidding process convince you that advanced development and prototyping activities will serve the best interests of the computing research community and the GENI project?

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Adhoc Review or Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the date of receipt. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided

automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (GC-1); * or Federal Demonstration Partnership (FDP) Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/general_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpm.

Special Award Conditions: The GPO, in consultation with the cognizant NSF Program Official will review and approve subcontracts and consultants.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after expiration of a grant, the PI also is required to submit a final project report.

Failure to provide the required annual or final project reports will delay NSF review and processing of any future funding increments as well as any pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete.

The activities of the GENI Project Office will be monitored through quarterly interim progress reports. In lieu of a fourth quarter report, an annual report on progress and plans will be submitted by the awardee to the cognizant NSF Program Manager. NSF will provide the format for these reports within one month of the award date. Both quarterly and annual reports must address progress of the GENI Project Office regarding the duties outlined in this solicitation.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Guru Parulkar, telephone: (703) 292-8950, email: gparulka@nsf.gov
- Cheryl F. Albus, telephone: (703) 292-7051, email: calbus@nsf.gov
- Sonya Lucas, telephone: (703) 292-7063, email: slucas@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.
- Sonya Lucas, telephone: (703) 292-7063, email: slucas@nsf.gov

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, MyNSF (formerly the Custom News Service) is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Regional Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. MyNSF also is available on NSF's Website at <http://www.nsf.gov/mynsf/>.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this new mechanism. Further information on Grants.gov may be obtained at <http://www.grants.gov>.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at <http://www.nsf.gov>

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center): (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

Send an e-mail to: pubs@nsf.gov
or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Division of Administrative Services
National Science Foundation
Arlington, VA 22230

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